Amendments to the Specification

Please amend the specification as follows:

Please replace the paragraph spanning page 2, line 25 to page 3, line 5 with the following paragraph:

In M. I. Trifonov and P. A. Medinnikov, *Sov. J. Opt. Technol.*, 58, 235-238 (1991) there is reported a local radial angular transform for images ('~~loral~~LORA' transform). This transform is described for a hexagonal grid representation of a binary image, which does not conform to the conventional representation of an image as pixels on a rectangular grid. The same transform in a hierarchical hexagonal form was also briefly discussed in M. I. Trifonov and Yu. E. Shelepin, *Perception*, 21, Suppl. 2, 54 (1992). In this publication, the role of the transform as a possible model for the early stages of human vision was considered with relation to the ability for visual detection of shapes. However, no practical application of the local radial-angular transform in image processing has been reported.

Please replace the paragraph at page 4, lines 3-4 with the following paragraph:

Figure 6 illustrates an orientation of a quasipixel that does not fall exactly on pixels boundaries, illustrating a situation where pixels have partial membership of a given ~~quasipixel~~quasipixel.

Please insert the following two paragraphs at page 5, line 24, after the paragraph briefly describing Figure 28:

Figure 29 illustrates operations 2900 in an exemplary processing of digital image data.

Figure 30 illustrates operations 3000 in another exemplary processing of digital image data.

Please replace the one line paragraph at page 8, line 2 with the following paragraph:

$$\underline{R_{km} = (1/\sqrt{6}\,)\ \|\ exp[i\,(k-1)\,(m-1)\,\pi/3]\ \|,\ (k, m = 1,2 \ldots 6)}$$

$$\cancel{R_{km} = (1/\sqrt{6})\ \|\ exp[i\,(k\ \ 1)\,(m\ \ 1)\,\pi/3]\ \|,\ (k, m = 1,2 \ldots 6)}$$

Please replace the paragraph at page 8, lines 4-8 with the following paragraph:

where *i* is the imaginary unity (i.e., the square root of –1), π is the ratio of the circumference to the diameter of a circle, and k and m are the row and column indices of the matrix elements. For another geometric figure, the numbers would be adjusted to reflect the different number of groups (e.g., 8, [[10]] 10, 12, etc., in the geometric pattern). The matrix R may be represented for convenience in terms of a real matrix P and an imaginary matrix Q according to:

Please replace the one line paragraph at page 8, line 10 with the following paragraph:

$$\underline{R = [1/(2\sqrt{6}\,)]\,P + i\,[1/(2\sqrt{2}\,)]\,Q}$$

$$\cancel{R = [1/(2\sqrt{6})]\,P + i\,[1/(2\sqrt{2})]\,Q}$$

Please replace the one line paragraph at page 8, line 18 with the following paragraph:

$$\underline{Q_{km} = (2/\sqrt{3}\,)\ \|\ sin[\,(k-1)\,(m-1)\,\pi/3]\ \|,\ (k, m = 1,2 \ldots 6)}$$

$$\cancel{Q_{km} = (2/\sqrt{3})\ \|\ sin[\,(k\ \ 1)\,(m\ \ 1)\,\pi/3]\ \|,\ (k, m = 1,2 \ldots 6)}$$

Please replace the one line paragraph at page 9, line 5 with the following paragraph:

$$\underline{Real(c_k) = (0.5/\sqrt{6}\,)\,(P_{k1}B_1 + P_{k2}B_2 + P_{k3}B_3 + P_{k4}B_4 + P_{k5}B_5 + P_{k6}B_6)}$$

$$\cancel{Real(c_k) = (0.5/\sqrt{6})\,(P_{k1}B_1 + P_{k2}B_2 + P_{k3}B_3 + P_{k4}B_4 + P_{k5}B_5 + P_{k6}B_6)}$$

Please replace the one line paragraph at page 9, line 6 with the following paragraph:

$$\underline{\text{Imaginary}(c_k) = (0.5/\sqrt{2})\,(Q_{k1}B_1 + Q_{k2}B_2 + Q_{k3}B_3 + Q_{k4}B_4 + Q_{k5}B_5 + Q_{k6}B_6)}$$

$$\cancel{\text{Imaginary}(c_k) = (0.5/\sqrt{2})\,(Q_{k1}B_1 + Q_{k2}B_2 + Q_{k3}B_3 + Q_{k4}B_4 + Q_{k5}B_5 + Q_{k6}B_6)}$$

Please replace the one line paragraph at page 9, line 10 with the following paragraph:

$$\underline{c_1 = (1/\sqrt{6})\,(B_1 + B_2 + B_3 + B_4 + B_5 + B_6)}$$

$$\cancel{c_1 = (1/\sqrt{6})\,(B_1 + B_2 + B_3 + B_4 + B_5 + B_6)}$$

Please replace the one line paragraph at page 9, line 11 with the following paragraph:

$$\underline{c_2 = (0.5/\sqrt{6})\,(2B_1 + B_2 - B_3 - 2B_4 - B_5 + B_6) + i\,(0.5/\sqrt{2})\,(B_2 + B_3 - B_5 - B_6)}$$

$$\cancel{c_2 = (0.5/\sqrt{6})\,(2B_1 + B_2 - B_3 - 2B_4 - B_5 + B_6) + i\,(0.5/\sqrt{2})\,(B_2 + B_3 - B_5 - B_6)}$$

Please replace the one line paragraph at page 9, line 12 with the following paragraph:

$$\underline{c_3 = (0.5/\sqrt{6})\,(2B_1 - B_2 - B_3 + 2B_4 - B_5 - B_6) + i\,(0.5/\sqrt{2})\,(B_2 - B_3 + B_5 - B_6)}$$

$$\cancel{c_3 = (0.5/\sqrt{6})\,(2B_1 - B_2 - B_3 + 2B_4 - B_5 - B_6) + i\,(0.5/\sqrt{2})\,(B_2 - B_3 + B_5 - B_6)}$$

Please replace the one line paragraph at page 9, line 13 with the following paragraph:

$$\underline{c_4 = (1/\sqrt{6})\,(B_1 - B_2 + B_3 - B_4 + B_5 - B_6)}$$

$$\cancel{c_4 = (1/\sqrt{6})\,(B_1 - B_2 + B_3 - B_4 + B_5 - B_6)}$$

Please replace the one line paragraph at page 9, line 14 with the following paragraph:

$$\underline{c_5 = (0.5/\sqrt{6})\,(2B_1 - B_2 - B_3 + 2B_4 - B_5 - B_6) - i\,(0.5/\sqrt{2})\,(B_2 - B_3 + B_5 - B_6)}$$

$$\cancel{c_5 = (0.5/\sqrt{6})\,(2B_1 - B_2 - B_3 + 2B_4 - B_5 - B_6) - i\,(0.5/\sqrt{2})\,(B_2 - B_3 + B_5 - B_6)}$$

Please replace the one line paragraph at page 9, line 15 with the following paragraph:

$$\underline{c_6 = (0.5/\sqrt{6})(2B_1 + B_2 - B_3 - 2B_4 - B_5 + B_6) - i\,(0.5/\sqrt{2})(B_2 + B_3 - B_5 - B_6)}$$

$$\cancel{c_6 = (0.5/\sqrt{6})(2B_1 + B_2 - B_3 - 2B_4 - B_5 + B_6) - i\,(0.5/\sqrt{2})(B_2 + B_3 - B_5 - B_6)}$$

Please replace the paragraph at page 9 lines 17-21 with the following paragraph:

It can be seen that [[c6]] $\underline{c_6}$ is the complex conjugate of [[c2]] $\underline{c_2}$, and [[c5]] $\underline{c_5}$ is the complex conjugate of [[c3]] $\underline{c_3}$. Since the modulus $|z|$ of a complex number $z = a + ib$ is given by $|z|$ = [[$\sqrt{(a^2 + b^2)}$]] $\underline{\sqrt{(a2 + b2)}}$, then $|c_2| = |c_6|$ and $|c_3| = |c_5|$. Further, it can be noted that coefficient c_1 is simply indicative of the mean channel value or brightness under the hexon. There are separate coefficients c_{1k} and c_{2k} for the orientations 1 and 2 of a hexon, such as shown in Figure 1.

Please replace the one line paragraph at page 10, line 21 with the following paragraph:

Quasipixel 1 = 1 ~~pixel~~pixel.

Please replace the paragraph spanning page 13, line 10 to page 14, line 6 with the following paragraph:

For any hexon type, such as those exemplified in Figures 1 to 17, a coefficient c_k is calculated for every position of the hexon in relation to the image pixels. That is to say, the hexon center position is moved pixel by pixel across the rows and down the columns of the image until it has been positioned over every image pixel of interest. The result is an image formed from c_k responses that is identical in size to the original image area of interest. It is also possible to move the hexon in larger steps. For instance, hexons composed of quasipixels comprising several pixels may be moved in steps equal to the quasipixel width or height. In such a case the output image will be smaller than the input image, being effectively a lower resolution or coarser scale image. The value of c_k calculated for the hexon is a property of the central pixel of the hexon. In other words, it is a property of the central pixel of the quasipixel labeled 0 in Figures 1 to 17. When the width and height of the quasipixel is an odd number of pixels there is no ambiguity about

the location of the center pixel. However, when the quasipixel has even dimensions, the center of the quasipixel does not coincide with an image pixel. In such a case it is usually sufficient to assign c_k to that image pixel lying closest to the center of the quasipixel. When several ~~pixel~~ pixels lie at equal distances from the center of the quasipixel an arbitrary choice can be made. For example, referring to Figure 1, c_k may be assigned to the top left pixel of quasipixel 0. It is also possible in such a case to form an improved value of c_k at a given pixel by averaging the responses from several positions of the central quasipixel each lying over the pixel in question. For instance, referring to Figure 1, the response at a given pixel may also be formed as the average of c_k values obtained by positioning in turn the top left, top right, bottom left and bottom right elements of quasipixel 0 over the given image pixel. Alternatively, all pixels lying under central quasipixel may be assigned the value of c_k determined for one pixel in this region. There is a separate value of $|c_k|$ for orientation 1 and orientation 2 of the hexon. These separate values $|c_{1k}|$ and $|c_{2k}|$ may be combined into a single value $|c_k|$, for instance by taking the larger of the two.

Please replace the paragraph at page 15, lines 7-13 with the following paragraph:

The c_3 coefficient responds to lines that are both dark and light with respect to the background upon which they lie and by default both types of lines are detected. However, it is also possible to selectively detect only light lines or only dark lines. This may be achieved in various ways. For example, the mean brightness or channel value at the quasipixels lying closest to the line may be compared to the value of [[$c_1/\sqrt{6}$]] $\underline{c_1/\sqrt{6}}$. Alternatively, the lightness or darkness of a line may be estimated from the real and imaginary parts of the c_3 coefficient by comparison to thresholds T_1 and T_2 according to the following logic:

Please replace the paragraph at page 18, lines 9-18 with the following paragraph:

Example 11 (Figure 28) presents some shapes on a 50% gray background, magnified six-fold for clarity. The image was processed with the hexon of Example 5 having 10 pixel by 10 pixel quasipixels with restriction of responses according to $|c_2| < 0.39|c_k|_{max}$, $|c_3| < 0.39|c_k|_{max}$, $|c_4| < 0.39|c_k|_{max}$ and $\cancel{|B_0 - c_1/\sqrt{6}| > 0.21B_{max}}$ $\underline{|B_0 - c_1/\sqrt{6}| \geq}$

$\underline{0.21B_{max}}$, where $|c_k|_{max}$ is the largest value of $|c_k|$ anywhere in the image and B_{max} is the maximum brightness of the image. In this example both of these values are 255. When all of $|c_2|$, $|c_3|$, $|c_4|$, $|c_5|$ and $|c_6|$ are small and ~~$|B_0 - c_1/\sqrt{6}|$~~ $\underline{|B_0 - c_1/\sqrt{6}|}$ is large, then ~~$|B_0 - c_1/\sqrt{6}|$~~ $\underline{|B_0 - c_1/\sqrt{6}|}$ responds to a disk-like or ring-like forms. The locations of this response are shown in Figure 28 in white for black shapes and in black for white shapes centered in the shapes. The responses demonstrate that disks and rings can be detected. Two disks are too large to detect with the hexon used and two rings are too thin to detect with this hexon.

Please insert the following two paragraphs at page 18, line 20, after the last paragraph of the specification:

Figure 29 illustrates operations 2900 in an exemplary processing of digital image data. Such operations 2900 can be implemented by a computer having hardware and software that enable execution of the process that processes digital image data. An overlaying operation 2902 overlays a hexon pattern structure on the digital image data to define a central area comprising a pixel or group of pixels. The geometric pattern (e.g., the hexon pattern structure) comprises a group of six pixels and/or a pattern of six groups of pixels surrounding the central area. The overlaying of the geometric pattern defines a geometric region in relation to the central area. An assigning operation 2904 assigns brightness values to the pixels within the groups of pixels and/or to individual groups of pixels. In a comparison operation 2906, the brightness values of the groups of pixels are compared using a local radial angular transform. A detection operation 2908 detects regions of contrast within the image data. The detected regions of contrast can be used to determine whether a line, a semi-plane, a triangular shape, a line junction, a disk shape, or a ring shape is present in the image.

Figure 30 illustrates operations 3000 in another exemplary processing of digital image data. Such operations 3000 can be implemented by a computer having hardware and software that enable execution of the process that processes digital image data. A transform operation 3002 applies a local radial angular transform to the digital image data to provide transform coefficients of c_1, c_2, c_3, and c_4. A line detection operation 3004 detects line objects using a modulus of the c_3 transform coefficient. A semi-plane

detection operation 3006 detects semi-plane objects using a modulus of the c_4 transform coefficient. A line intersection detection operation 3008 detects triangle objects or line junction objects using a modulus of the c_4 transform coefficient. A ring detection operation 3010 detects ring objects or disk objects using a modulus of the value $\left(B_0 - \frac{c_1}{\sqrt{6}}\right)$, wherein B_0 represents a brightness value or a color value of a central element of elements used in the local radial angular transform.